DECOMPOSING INEQUALITY IN COMPULSORY EDUCATION FINANCE IN CHINA: 1998-2008

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ABSTRACT

In recent decades, the inequality in compulsory education finance in China has remained a widespread and serious problem. Based on a provincial-level dataset in the period of 1998-2008, this study analyzed the disparities of school funding in China, attempting to explore the important factors that may have contributed to the inequality. Using the methods of factor decomposition and regression-based decomposition of Gini coefficient, it showed that the inequality of school funding had not been reduced after recent governmental reforms. The level of economic development appeared to be highly associated with the inequality of expenditures for compulsory education. The empirical results of this analysis suggest that a sound system of intergovernmental fiscal transfers with built-in equalization features may need to be developed in China.

1. INTRODUCTION

Though the finance schemes vary, most governments in the world provide basic education to their citizens. Equal opportunities to develop their talents are often considered by many as people's fundamental human rights (Faure et al., 1972; Lin, 2009). Since education is one of the major channels for individuals to move up the social ladder in China, disparities in access and quality of education will inevitably result in inequality in people's income and social status, and the inequality may become transmittable across generations (Lin, 2009). Though education expenditures do not provide an ideal measure of the underlying resources used by local governments for education or the outcomes of the process (Johnston and Duncombe, 1998), it remains a fundamental benchmark in evaluating the equality of public education system and continues to be an important concern of the public and the education community (Moser and Rubenstein, 2002). In recent decades, the Chinese government has implemented a series of reforms on its finance system for the nine-year compulsory education. Nevertheless, the school funding inequality across different regions has remained a widespread and serious problem even after several rounds of reforms, which has attracted a lot of public and academic attention in recent years.

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Since the 1985 education finance reform, China has established a highly decentralized compulsory education finance system, with education funding relying more and more on revenue resources provided by local governments (Wang and Zhao, 2012).[1] Later, two major governmental reforms in the country had an important impact on the compulsory education finance system. The first was the reform of the tax sharing system after 1994, which reinforced the central government's financial resources, leaving local authorities with insufficient fiscal capacity for funding compulsory education, especially in rural areas. The second was the implementation of rural taxation reforms since 2000 that led to the establishment of a new mechanism for financing compulsory education (Ding, 2008; Zhou and Liu, 2008) with the central and provincial governments playing a much more important role than before.

Employing multiple methods, including factor decomposition and regression-based decomposition of Gini coefficient, this analysis intends to answer three research questions: First, what was the status of inequality in compulsory education finance after recent reforms in China? Second, how did each revenue source contribute to the inequality in total school revenues? Third, what major factors were associated with the inequality of spending for compulsory education in China? The empirical results of the analysis will provide new insights to identify the major factors that have contributed to the inequality in compulsory education finance and carry important implications for future governmental reforms in China.

The analysis is conducted based on a provincial-level dataset in the period of 1998-2008. Investigating the inequality of funding for compulsory education at the provincial level can be very informative because the effectiveness of national equalization policies often depends on the behavior and policies of the 31 provincial-level governments, which consist of 22 provinces, 5 Minority Autonomous Regions, and 4 Municipalities. As Martinez-Vazquez et al. (2008) point out, in order to improve equity in the distribution of fiscal resources throughout the country, it may be necessary to determine to what extent provincial government actions contribute to or run counter to central government equalization objectives. Scholars who do educational research have also repeatedly argued that it would be beneficial for improving education equity if we could establish a compulsory education finance system in which provincial governments play a leading role (Wang et al., 2003; Wang, 2004). With the provincial governments being assigned greater responsibilities in the recently established new mechanism of compulsory education finance, the results of this analysis have important implications for understanding the behavior of provincial governments in the delivery of basic public services, in particular, compulsory education, thereby

1. Local governments in this article refer to sub-provincial governments, including cities, urban districts, counties, townships and villages etc.

contributing to making more effective policies for addressing inequality in compulsory education finance in China.

This paper is divided into six sections. Following the introduction is a description of the major reforms related to China's compulsory education finance system. The third section provides a review of previous literature. The fourth section describes data and methodology for empirical analysis. The fifth section evaluates the inequality in revenue and spending for compulsory education and the major factors that were associated with the inequality over the period of 1998-2008, using the methods of factor decomposition and regression-based decomposition of Gini coefficient. The final section concludes with a discussion of directions for future research.

2. CHANGES IN CHINA'S COMPULSORY EDUCATION FINANCE SYSTEM

2.1 The Education Finance Reform of 1985

In 1985, China officially launched a reform that changed its formerly centralized compulsory education system with a narrow revenue base to a decentralized system with revenue collected from both budgetary and extra-budgetary sources (Tsang, 1996).[2] After the reform, extra-budgetary funds generated at the local level constituted an increasing share of total resources to compulsory education, and local governments became the primary financing source for compulsory education (Tsang, 1996; Tsang, 2001). The over-decentralization of education financing put a great financial strain on local governments and resulted in a large disparity in funding for compulsory education (Tsang, 2000). Later, the tax sharing reform in 1994 left local authorities with insufficient fiscal capacity for funding the provision of compulsory education. With reduced fiscal capacity, provincial, and especially sub-provincial, governments often relied heavily on informal levies to make up for insufficient funding in the 1990s (Lin et al., 2007), which, over time, led to an excessive tax burden for farmers in rural areas (Ding, 2008; Zhou and Liu, 2008).

2.2 The "Tax-For-Fee" Reform

Since 2000, the Chinese central government has implemented a series of

2. The budgetary funds included allocations of local governments' own-source revenue, and categorical grants from central and provincial governments, which comprised of only a minor share of funding for education. The extra-budgetary funds included funding from education surcharges in urban areas and education levies in rural areas as well as social contributions and school fees etc. See Tsang (1996) for a more detailed description on various budgetary and extra-budgetary funds for education.

"Tax-For-Fee" rural taxation reforms, abolishing all fees collected previously by townships and villages and replacing them with agriculture taxes and related surcharges (Lu et al., 2004). At the beginning of 2006, the government decided to phase out agricultural taxes completely (Lin et al., 2007). In the process of eliminating fees and agricultural taxes, the system whereby local governments assumed the major responsibility of funding for rural compulsory education could no longer be maintained (Zhou and Liu, 2008). Therefore, it became necessary for the government to establish a new scheme for financing its school system.

2.3 The New Mechanism

In the wake of the rural taxation reform, the Chinese central government has begun to take on more financial responsibility for compulsory education since 2001. It has introduced the "two exemptions and one subsidy" policy (TEOS) for the purpose of easing the financial difficulties shouldered by local governments and reducing the financial burdens of rural families for paying for their children's education. Under this system, governments provide free textbooks to poor rural students as well as an exemption from "miscellaneous fees" (*zafei*) to the same students (the two exemptions), along with a subsidy to cover living costs for boarding students with financial difficulties (the one subsidy) (Brock et al., 2008). The central government originally only provided free textbooks to poor rural students. Since 2006, it has significantly increased its own share of funding to the TEOS program to cover the majority of costs for the exemption of miscellaneous fees. For western provinces, the central government provides 80% of the costs and the provincial and local government 20%. For provinces in central China, the central government covers 60%, and the shares for eastern provinces are negotiated on a case-by-case basis. Since 2007, the central government has begun to provide one-third of the funding for the subsidy for boarding students, with the rest of the costs shared among the province, prefecture, and county levels (Brock et al., 2008).

The expansion of the programs of TEOS has led to the formulation of a new finance mechanism for rural education (hereafter the "New Mechanism") (Broack et al., 2008). In addition to TEOS, the New Mechanism includes measures to raising the overall level of public expenditure for rural compulsory education, creating a mechanism for more investment into rural school buildings, and ensuring prompt and full issuance of salaries to rural school teachers. The New Mechanism has been implemented in the western provinces since 2006, and has been extended to other provinces in the next year (Ding, 2008). The Chinese government has decided to provide a completely free compulsory education for all children in both rural and urban

areas nationwide since 2008.[3]

3. LITERATURE REVIEW

Since the 1990s, studies using province as a unit of analysis consistently found that severe inequality existed in funding for China's compulsory education (Tsang, 1994; Jiang and Zhang, 1999; Li, 2008). Tsang (1994) showed that, in 1989, the top-spending province spent as much as 5.2 times that of the bottom-spending province in primary education; the corresponding ratio was 4.5 in secondary (both lower- and upper-) education. In 2000, these ratios rose to 10.6 in primary education and 6.6 in lower-secondary education (Tsang, 2001). Jiang and Zhang (1999) found that the ratio of total school spending among the three "Education Regions" in the country grew from 2.8:1.5:1.0 in 1988 to 3.0:2.0:1.0 in 1992.[4]

In the previous literature, few scholars used decomposition methods to assess the impact of China's education finance and taxation reforms on the inequality of China's Compulsory education. This study contributes to the literature on this topic by employing the methods of inequality decomposition that have recently become available, using a panel dataset from recent years. The analysis of Li (2009) showed the change in disparities before and after the Tax-For-Fee reform based on a provincial-level dataset in 1995-2006. He found that the Theil index of per-pupil spending for primary schools increased after the reform, while that for lower-secondary schools increased even more substantially. The results of factor decomposition of inequality measures showed that the aid provided by the central government after the reform helped to reduce the inequality of spending within, but not across the eastern, central, and western regions. One possible explanation of the results was that the fiscal transfers from the central government probably only made up for the loss of education revenue collected from farmers, but were inadequate to substantially reduce the ever increasing disparities in fiscal capacity across the three regions.

A number of studies investigated the factors that affected provincial education expenditures and their disparities in China, which suggested a framework for this analysis on what major factors might be associated with the inequality of spending for compulsory education. Previous research found

3. For recent policy changes on China's compulsory education, please see http://news.xinhuanet.com/newscenter/2008-07/31/content_8867264.htm; accessed January 18, 2011.

4. In 1994, the Ministry of Education in China grouped all provinces into three regions based on the progress and capacity in achieving the universalization of nine-year compulsory education and the eradication of adult illiteracy. Please see Tsang and Ding (2005) for details on the three regions.

mixed results concerning the impact of economic development on education spending. For example, Wang et al. (1998) showed that provincial education expenditures were mainly determined by their level of economic development. Similarly, Wei and Yang (1998) found that uneven economic development caused severe disparities in education expenditures in different regions, due to the decentralization of funding for compulsory education, and the non-existence of a sound system of fiscal transfers from the central to provincial governments. Contrary to some early studies, Wang and Yang (2008) found that provincial economic development did not contribute to increasing education spending as a share of GDP or total budgetary spending. The authors argued that, for provincial government officials, education development might not be as important as some other competing goals such as economic growth.

In addition, Wang and Yang (2008) found that a higher share of state-owned economy in total economy was associated with a lower share of educational investment in total budgetary expenditures. This suggested that the demand for governmental investment in state-owned enterprises might have prevented the allocation of more funding for education. The share of primary industry in total value of production also had a negative effect on the shares of education spending, which indicated that agricultural provinces might have different demand and preferences for educational investment in comparison to other more developed ones.

4. DATA AND METHODOLOGY

A dataset for all provincial-level governments from 1998-2008 is used for this analysis. Expenditure and revenue data for compulsory education are collected from various issues of the *China Educational Finance Statistical Yearbook*. Data for other socio-economic and demographic variables are from China Data Online run by All China Data Center.[5]

In order to address the first research question concerning the status of inequality in compulsory education finance, descriptive statistics and Gini coefficients of education revenues and expenditures are reported for primary and lower-secondary schools in both urban and rural areas. To answer the second research question, a factor decomposition of Gini coefficient (Fei et al., 1978; Shorrocks, 1982; Lerman and Yitzhaki, 1985) is adopted to examine the contribution of each revenue source to the dispersion of total school revenues. To address the third research question regarding the factors associated with the inequality of expenditures for compulsory education, regression-based decomposition is employed to investigate the contribution of various factors to

5. For information on China Data Online, please see http://chinadatacenter.org/; accessed January 18, 2011.

the total inequality (please see the Appendix for technical details of factor and regression-based decomposition). Decomposition by factor component needs to have complete information on all income sources and express total income as a sum of factor incomes. This approach only allows us to attribute total inequality to the income sources, not to the external factors that affect the inequality (Wan and Zhou, 2005). Following the methods proposed by Morduch and Sicular (2002), Fields (2003) and Qing and Tsui (2005), this analysis employs regression-based decomposition to explore the important factors that may have been associated with the inequality of expenditures for compulsory education in China. Using this method, the regression model is supplemented by decomposition analyses to quantify the relative contribution of different explanatory factors to the inequality. Based on the literature reviewed above, the following regression model is developed for the analysis:

$$ln(EXP) = \alpha + \beta_1 \ln(GDP) + \beta_2 STATE + \beta_3 PRIM + \beta_4 TERT + \beta_5 \ln(DEN) + \beta_6 \ln(REV) + \beta_7 EAST + \beta_8 CENTRAL + \beta_9 MUN + \beta_{10} MIN + \varepsilon$$

A double-log specification is adopted for the model. The dependent variable in the model is the natural log of per-pupil real spending, EXP, for primary and lower-secondary schools. GDP is per capita real GDP. STATE is the share of state-owned units in total investment in fixed assets, which proxies the economic ownership structure in provinces. PRIM is the share of primary (agriculture) industry output in total GDP, and TERT refers to the share of people employed by the tertiary (service) industry. These two variables indicate the industrial structure in provinces. DEN refers to population density, and REV per capita real budgetary revenue. The model also includes four dummy variables indicating the eastern region, the central region, the four municipalities, and the five minority autonomous regions. Though some important factors, such as the political economy of local decisions for education spending, are not controlled in this model due to data constraint, this exploratory research, as a first attempt to use regression-based decomposition for studying educational funding disparities in China, can still be informative and contribute to future research in this area.

5. INEQUALITY IN COMPULSORY EDUCATION FINANCE IN CHINA

Table 1 presents the per-pupil revenue and spending for primary and lower-secondary schools in all 31 provincial-level governments in China in 1998 and 2008. The per-pupil revenue increased from 764 RMB in 1998 to 3,030 RMB in 2008 for primary schools, and from 1,310 RMB to 3,743 RMB in the same period for lower-secondary schools all over the country. Similarly, the per-pupil spending for compulsory education also increased substantially from 1998 to 2008. Budgetary revenue as a share of total revenue increased substantially from 63% in 1998 to 87% in 2008 for primary schools, and from

59% to 79% for lower-secondary schools nationwide. This shows that the Chinese government substantially increased its funding from budgetary sources for compulsory education over the period of 1998-2008.

Table 1. Per-Pupil Education Revenue and Spending (in Real RMB)

Primary School					
			% of		
		Total	**Budgetary**	**% of**	**Total**
Year	**Area**	**Revenue**	**Revenue**	**Surcharge**	**Spending**
1998	Nationwide	764	63%	13%	746
	Eastern Region	1198	63%	14%	1173
	Central Region	549	56%	15%	537
	Western Region	639	73%	10%	621
	Rural area	652	64%	14%	637
2008	Nationwide	3030	87%	4%	2996
	Eastern Region	4988	82%	6%	4903
	Central Region	2075	87%	4%	2078
	Western Region	2453	93%	3%	2413
	Rural area	2887	92%	3%	2863
Lower-secondary School					
1998	Nationwide	1310	59%	13%	1275
	Eastern Region	1903	58%	14%	1843
	Central Region	968	53%	14%	944
	Western Region	1211	69%	10%	1187
	Rural area	1074	61%	14%	1056
2008	Nationwide	3743	79%	5%	3702
	Eastern Region	6409	74%	7%	6281
	Central Region	2430	78%	5%	2449
	Western Region	2975	84%	4%	2932
	Rural area	3342	88%	4%	3298

Note: Revenue and spending data in the table have been adjusted for inflation with year 2000 as the base year.

Comparing per-pupil education revenue and spending between rural areas and nationwide averages, rural areas had significantly lower revenue and spending for compulsory education in both 1998 and 2008. The differences in

education revenue between rural areas and national averages increased slightly from 1998 to 2008, whereas the differences in education spending declined moderately. To compare regional differences, in both 1998 and 2008 the eastern region had significantly higher education resources than the other two regions. In comparison to 1998, the gap between eastern and western regions widened in 2008. The higher reliance on budgetary revenue for provinces in the western region indicated that non-government resources continued to be more abundant in eastern and central regions (Tsang and Ding, 2005; Wang and Zhao, 2012).

Figure 1. Inequality in Education Revenue and Spending for Primary Schools (1998-2008)

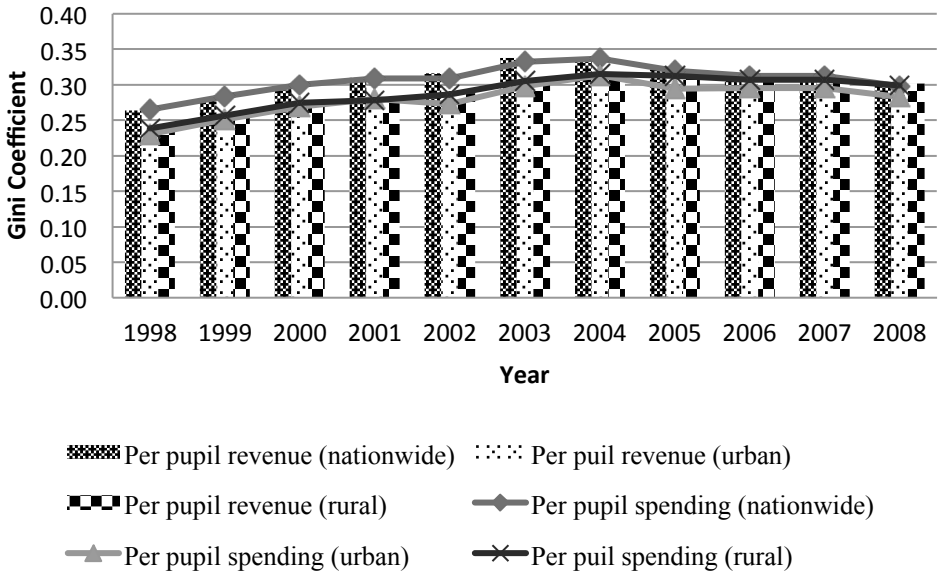

Figure 1 shows the Gini coefficients of per-pupil real revenue and spending nationwide and in both rural and urban areas for primary schools across all provinces from 1998 to 2008. The Gini coefficient of per-pupil revenue for primary schools increased from 0.26 in 1998 to a peak of 0.34 in 2003, and then decreased slightly to 0.30 in 2008. However, the Gini coefficient was still higher in 2008 than in 1998 after the implementation of the rural taxation reforms. In this period, the Gini coefficients of per-pupil revenue in rural areas were slightly higher than those in urban areas. A similar trend of change can be observed in Gini coefficients of per-pupil education spending nationwide and in both rural and urban areas over 1998-2008, with rural areas showing a slightly higher level of inequality than urban areas. This corresponds to previous studies (Kennedy, 2007; Wang and Zhao, 2012; Yep, 2004) that showed an exacerbation of inequality in revenue and spending for compulsory education in China due to the implementation of Tax-For-Fee

reforms. Later, the introduction of the New Mechanism under which the central and provincial governments took on more responsibility for funding compulsory education, especially in western and central regions that needed more financial aid, appeared to have helped to a certain extent to reduce the inequality in education revenue and spending.

Table 2. Factor Decomposition of Gini Coefficient of Education Revenue for Primary Schools

Year	Revenue Source	Gini	Pseudo-Gini /Gini Ratio	Relative Contribution	Marginal Effect
1998	Budgetary appropriation (operating purposes)	0.27	1.13	72.1%	8.2%
	Total surcharges		0.70	8.8%	-3.8%
	Institutional revenue (tuition and fees etc.)		0.82	9.9%	-2.1%
	Revenue from enterprises and services		0.96	2.3%	-0.1%
	Donation		0.36	1.9%	-3.3%
	Capital revenue		0.22	0.3%	-1.0%
	Other revenue		1.77	4.8%	2.1%
2007	Budgetary appropriation (operating purposes)	0.32	0.95	79.2%	-4.3%
	Total surcharges		1.74	9.9%	4.2%
	Institutional revenue (tuition and fees etc.)		0.88	5.1%	-0.7%
	Revenue from enterprises and services		0.92	0.3%	0.0%
	Donation		1.14	1.2%	0.1%
	Capital revenue		0.83	1.3%	-0.3%
	Other revenue		1.45	3.0%	0.9%

Note: Financial variables in the table have been adjusted for inflation with year 2000 as the base year.

In the next step, the method of factor decomposition of Gini coefficient is employed to show the impact of various revenue sources on the inequality of

per-pupil revenue for compulsory education across provinces. Data for per-pupil education revenue in 1998 and 2007 is used for this analysis.[6] The reason for selecting these years is that it covers the period from before the Tax-For-Fee reform and after the introduction of the New Mechanism for funding compulsory education in China.

Table 2 presents the results of factor decomposition of Gini coefficient of education revenue for primary schools. The ratio of the pseudo-Gini of each revenue category to the Gini coefficient of total revenue shows the impact of each revenue source on the inequality of total revenue. If the ratio is larger than 1, it indicates that the revenue category is more widely dispersed along the rank of the total revenue. Thus it is a driving force of the overall inequality of total revenue. If the ratio is positive and smaller than 1, it suggests that the spending or revenue category has a weak equalization or "pooling" effect on the overall inequality. An intuitive analogy of the "pooling" effect is that dispersion acts like financial risk; combining multiple dispersed items tend to produce a less dispersed distribution (Zhao and Hou, 2008). Only when the ratio has a negative value, the spending or revenue category would have a strong equalization or offsetting effect on the inequality of total spending or revenue (Zhao, 2009).

The Gini coefficient of per-pupil total revenue for primary schools increased from 0.27 in 1998 to 0.32 in 2007. Budgetary appropriation for operating purposes had a pseudo-ratio of larger than 1 in 1998, indicating that it contributed to increasing the Gini coefficient of total education revenue. The rest of the revenue sources, except for other revenue, had a pseudo-ratio of smaller than 1, suggesting that they helped to reduce the overall inequality in education revenue in 1998. In comparison to 1998, both budgetary appropriation for operating purposes and education surcharges had a different impact in 2007. Budgetary appropriation for operating purposes had a weak equalizing effect since its pseudo-ratio is 0.95, while education surcharges, with a pseudo-ratio of 1.74, contributed to driving up the overall inequality in education revenue. The results suggested that after the gradual elimination of rural surcharges in all provinces in consequence of the rural taxation reform, the increase of budgetary appropriations for local governments helped to reduce inequality in total education revenue. However, the existing urban and local surcharges still contributed to higher inequality.[7] Donation, with a pseudo-ratio of 1.14, also contributed to increasing the Gini coefficient of total

6. The categorization of education revenue for 2008 is slightly different from that for previous years in the *China Educational Finance Statistical Yearbook*.

7. Surcharges for education were consisted of rural surcharges, urban surcharges, and local surcharges before the rural taxation reform. Rural surcharges were abolished due to the reform.

education revenue in 2007. It might be due to the fact that urban areas could attract more donations for education than rural areas.

The relative contribution of each revenue source to the Gini coefficient is determined by both the share of each revenue source in total revenue and the pseudo-ratio.[8] In 1998 and 2007, budgetary appropriation (operating purposes) contributed the most to the total inequality in comparison to other revenue sources, given its large share in total revenue. In 1998, it contributed 72.1% to the total inequality, whereas its contribution increased to 79.2% in 2007. The contribution of total surcharges to total inequality increased from 8.8% in 1998 to 9.9% in 2007. The contribution of institutional revenue, including tuition and fees, dropped from 9.9% in 1998 to 5.1% in 2007.

The final column of Table 2 shows the marginal effect of a small percentage change in a revenue source on the inequality of total revenue, holding all other revenue sources constant. One important change is the marginal effect of budgetary appropriation for operating purposes. A one-percent increase in budgetary appropriation for operating purposes drove up the Gini coefficient of total education revenue for primary schools by 8.2% in 1998, whereas it reduced the coefficient by 4.3% in 2007. This suggested that budgetary appropriation for operating purposes began to have an equalizing effect after the introduction of New Mechanism for financing compulsory education in China. In comparison, total surcharges for education helped to reduce the overall inequality in education revenue in 1998, but contributed to increasing the inequality in 2007. Its marginal effect changed from -3.8% in 1998 to 4.2% in 2007. With a smaller share in total revenue, the marginal effect of institutional revenue dropped from -2.1% in 1998 to -0.7% in 2007.

Table 3 shows the results of factor decomposition of Gini coefficient of education revenue for lower-secondary schools. Similar to the results presented in Table2, the marginal effects of budgetary appropriation for operating purposes indicate that it contributed to increasing the overall inequality in total education revenue in 1998, but had an equalizing effect in 2007. In comparison, total surcharges for education helped to reduce the overall inequality in education revenue in 1998, but contributed to increasing the inequality in 2007. It shows that local governments with lower revenue capacity relied on surcharges for funding their compulsory education before the rural taxation reform. After the gradual elimination of rural surcharges in all provinces, local governments relied more on budgetary appropriations for funding, and the existing urban and local surcharges actually contributed to higher inequality in total education revenue.

8. Please see the Appendix for the formulas for the calculation of relative contribution and marginal effect of each factor component to total inequality.

Table 3. Factor Decomposition of Gini Coefficient of Education Revenue for Lower-secondary Schools

		Gini	Pseudo-Gini /Gini Ratio	Relative Contribution	Marginal Effect
1998	Budgetary appropriation (operating purposes)	0.27	1.06	62.6%	3.8%
	Total surcharges		0.69	8.7%	-3.9%
	Institutional revenue (tuition and fees etc.)		0.87	12.8%	-1.9%
	Revenue from enterprises and services		1.12	3.0%	0.3%
	Donation		0.90	5.7%	-0.6%
	Capital revenue		0.75	1.0%	-0.4%
	Other revenue		1.76	6.2%	2.7%
2007	Budgetary appropriation (operating purposes)	0.32	0.92	68.5%	-6.3%
	Total surcharges		1.66	12.2%	4.8%
	Institutional revenue (tuition and fees etc.)		0.87	8.9%	-1.4%
	Revenue from enterprises and services		1.04	0.5%	0.0%
	Donation		1.43	1.9%	0.6%
	Capital revenue		1.22	3.6%	0.7%
	Other revenue		1.58	4.3%	1.6%

Note: Financial variables in the table have been adjusted for inflation with year 2000 as the base year.

The final step of the analysis is to use the regression-based approach to decompose the major factors that may have been associated with the inequality of expenditures for compulsory education. Summary statistics of the variables included in the regression model are reported in Table 4.

Table 4. Summary Statistics of Variables in the Regression Model (1998-2008)

Variable	Mean	Std. Dev.	Min	Max
EXP (per-pupil real education expenditure)	4020.64	3508.48	808.80	24345.18
GDP (per capita real GDP)	12859.91	10069.65	2294.74	60715.16
STATE (share of state-owned units in total investment in fixed assets)	46.95	14.42	14.54	95.89
PRIM (share of primary industry output in GDP)	15.65	7.62	0.82	37.91
TERT (share of people employed by the tertiary industry)	31.42	8.46	16.34	72.53
DEN (population density)	1084.05	3454.65	1.44	19377.02
REV (per capita real budgetary revenue)	1083.52	1415.25	142.99	10370.78
EAST (eastern region)	0.29	0.45	0.00	1.00
CENTRAL (central region)	0.42	0.49	0.00	1.00
MUN (municipalities)	0.13	0.34	0.00	1.00
MIN (minority autonomous regions)	0.16	0.37	0.00	1.00

Note: The number of observation is 341. Financial variables in the table have been adjusted for inflation with year 2000 as the base year.

To examine the major factors associated with the average education expenditures of provinces over time, between-effects models were estimated for the regression analysis, which attempted to model the mean response where the means are calculated for each of the provinces. In other words, the cross-sectional information reflected in the changes between provinces was used for this regression analysis. Four regression models were conducted for the whole period of 1998-2008, and the three separate periods of 1998-1999 (before the reform), 2000-2005 (rural taxation reform), and 2006-2008 (introduction of the New Mechanism). The empirical results are summarized in Table 5. The four regression models explain 85.7% to 92.6% of the log-variance of per-pupil real expenditure for primary and lower-secondary schools. The contributions of explanatory variables in the model to the inequality of education spending across provinces differ enormously. Among all the statistically significant variables in the model, per capita real GDP was the most important variable that was significantly associated with the

inequality of education spending, with a contribution of 78.1% in the whole period of 1998-2008, 93.6% in 1998-1999, 77.6% in 2000-2005, and 75.0% in

Table 5. Regression and Decomposition Results

	1998-2008		1998-1999		2000-2005		2006-2008	
	β	%	β	%	β	%	β	%
ln(GDP)	0.896***	78.1%	1.003***	93.6%	0.866***	77.6%	0.871***	75.0%
	(3.456)		(3.531)		(3.077)		(3.058)	
STATE	0.012*	-3.0%	0.010**	1.5%	0.018***	-7.4%	0.011	-2.6%
	(1.758)		(2.363)		(3.334)		(1.511)	
PRIM	0.018*	-14.4%	0.021**	-20.5%	0.016**	-13.9%	0.017*	-13.6%
	(2.055)		(2.402)		(2.18)		(1.793)	
TERT	0.018**	25.2%	-0.008	-8.4%	0.000	0.1%	0.019**	26.6%
	(2.491)		(-0.678)		(0.014)		(2.437)	
ln(DEN)	-0.029	1.4%	-0.041	4.1%	-0.016	1.2%	-0.032	1.6%
	(-1.019)		(-1.441)		(-0.589)		(-1.052)	
ln(REV)	-0.043	-4.9%	-0.071	-7.6%	0.205	23.3%	-0.057	-6.5%
	(-0.22)		(-0.329)		(0.879)		(-0.268)	
REG1	0.012	0.8%	0.065	4.1%	0.023	1.4%	0.050	3.1%
	(0.058)		(0.277)		(0.112)		(0.225)	
REG2	-0.204	9.0%	-0.141	7.1%	-0.120	5.9%	-0.159	7.1%
	(-1.545)		(-0.818)		(-0.799)		(-1.145)	
MUN	0.012	0.5%	0.280	12.0%	0.099	4.0%	0.022	0.9%
	(0.077)		(1.733)		(0.686)		(0.136)	
MIN	-0.122	0.0%	-0.058*	-0.3%	0.020	0.1%	-0.059	0.0%
	(-0.869)		(-0.346)		(0.142)		(-0.399)	
Constant	-0.909		-1.378		-2.228		-0.567	
	(-0.487)		(-0.749)		(-1.277)		(-0.277)	
Residual	*7.4%*		*14.3%*		*7.7%*		*8.5%*	
R-squared	*0.926*		*0.857*		*0.923*		*0.915*	
No. of Obs.	*341*		*62*		*186*		*93*	

Note: Significance levels are: ***p<0.01, **p<0.05, *p<0.10.

2006-2008, respectively. The share of state-owned units in total investment in fixed assets contributed to increasing the log-variance of education spending in 1998-1999, but it appeared to reduce the dispersion in 2000-2005. It did not have a significant impact in the model for 2006-2008. In the whole period of 1998-2008, it helped to reduce the inequality in education spending, with a

contribution of -3.0%. The share of primary (agriculture) industry output in total GDP contributed negatively to the inequality in education spending, with a share of -13.6% to -20.5% in the three separate time periods. The share of people employed by the tertiary (service) industry was significant in the models for 1998-2008 and for 2006-2008; it contributed positively to the dispersion in education spending, with a share of 25.2% in 1998-2008 and 26.6% in 2006-2008. Holding all other variables constant, population density and local revenue did not have a significant impact on the dependent variable. The dummy for minority autonomous regions had a significant effect on the dependent variable in 1998-1999, but its contribution was fairly small. All other dummy variables did not appear to have a conspicuous impact on the inequality of education spending.

6. CONCLUSION

Based on a provincial-level dataset in 1998-2008, this study examined the inequality in compulsory education finance after some recent governmental reforms in China. It found that the inequality of revenue and spending for primary and lower-secondary schools reached the peak during the rural taxation reform. The inequality only dropped moderately after the introduction of the New Mechanism for funding compulsory education.

Using factor decomposition of Gini coefficient to evaluate the contribution of various revenue sources to the inequality of total education revenue, this study found that budgetary appropriation for operating purposes as a share of total revenue became a much more important source of revenue after the rural taxation reform; it contributed to increasing the overall inequality in total education revenue in 1998, but began to have an equalizing effect in 2007 after the introduction of the New Mechanism for funding compulsory education. Local governments in rural areas relied on surcharges as an important source of revenue for education before the rural taxation reform. After the elimination of rural surcharges, local governments turned to budgetary appropriations for funding, but the existing urban and local surcharges still contributed to higher inequality in total education revenue. As indicated by previous studies, informal revenue sources, such as surcharges, could regain their importance for financing compulsory education due to insufficient local revenue capacity and imbalanced intergovernmental fiscal arrangements in China (Wang and Zhao, 2012). Policymakers may want to take careful measures to prevent them from becoming excessive again over time.

Finally, this analysis attempted to explore the major factors that may have been associated with the inequality of expenditures for compulsory education, using regression-based decomposition techniques. The empirical results of the analysis showed that, holding all other variables constant, per capita GDP had

a dominating effect on driving up the inequality of per-pupil spending for primary and lower-secondary schools. Other variables had different impact on the inequality over different periods of time, but their effects were not as conspicuous as per capita GDP. The insignificance of the per capita budgetary revenue variable suggested that provincial governments had not developed the revenue capacity to effectively mitigate the disparities in education expenditures resulted from uneven levels of economic development across provinces. The results of this exploratory research suggest that it remains a challenging task to make educational spending less dependent on or uncorrelated with the level of economic development. A sound system of intergovernmental fiscal transfers with built-in equalization features may still need to be put into place to help reduce the disparities in education resources across various provinces in China.

The exploratory study presented in this paper could be improved with a better model to capture the important factors, such as political economy factors, that affected spending for compulsory education in China, though the availability of data may be a constraint. In future research on China's education policy and finance, the methods of factor decomposition and regression-based decomposition can be used for different purposes. While factor decomposition can reveal funding inequality by revenue sources and by population subgroups, the regression-based method gives the opportunity to quantify the relative contribution of a set of explanatory variables that are correlated with the inequality in education spending. A caveat has to be made that the cost for the delivery of public education may vary significantly across geographic locations. Cost factors of education service should be incorporated in future research on the equity and adequacy of education finance in China.

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APPENDIX ON FACTOR AND REGRESSION-BASED DECOMPOSTION

Factor Decomposition

According to Fei, Ranis, and Kuo (1978), the Gini coefficient of income can be decomposed by the sources of income that make up the total income. Let Y_i^k denote the income of individual i (i = 1,…, n) from source k (k = 1,…, K), then the Gini coefficient of total income, $G(Y)$, can be transformed to

$$G(Y) = \sum_k \frac{\mu_k}{\mu} \overline{G}(Y^k) \quad (1)$$

where μ is the mean of Y, μ_k is the mean of Y^k, and

$$\overline{G}(Y^k) = \frac{2}{n^2 \mu_k} \sum_i (i - \frac{n+1}{2}) Y_i^k \quad (2)$$

is known as the pseudo-Gini for source k. It is not the conventional Gini value $G(Y^k)$, since the weights attached to Y_i^k correspond to the rank of individual i in the distribution of Y which, in general, is not the same as its rank in the distribution of Y^k. In addition, we can define the absolute and relative contribution of income source k to total income inequality as $S_k(G)$ and $s_k(G)$, respectively.

$$S_k(G) = \frac{\mu_k}{\mu} \overline{G}(Y^k); \quad s_k(G) = \frac{S_k(G)}{G(Y)} \qquad (3) \text{ and } (4)$$

Equivalently, Lerman and Yitzhaki (1985) show that we can decompose the impact of any income source upon total inequality in total income as the product of three easily interpreted terms: the share of the income source in total income, $\frac{\mu_k}{\mu}$, inequality in the distribution of the income source k, $G(Y^k)$, and the "Gini correlation" between the income source and the distribution of total income, R_k.[9] One advantage of this transformation is that we can also estimate the effect of a small change e in a specific income source k on inequality of total income, holding income from all other sources constant (See Lerman and Yitzhaki, 1985, p.153).

[9] The Gini correlation for source k is effectively the ratio of k's Pseudo-Gini over k's Gini coefficient. Similar to Pearson's correlation, the Gini correlation ranges between -1 and +1, but it will take on more extreme values than Pearson's (See Lerman and Yitzhaki, 1985, p.152).

$$\frac{\partial G / \partial e_k}{G} = s_k(G) - \frac{\mu_k}{\mu} \quad (5)$$

Regression-based Decomposition

In general, the inequality of the target variable (e.g. income) is decomposed into components associated with several determinant variables in the regression equation. The first step in the decomposition analysis is to run the income-generating function.

$$\ln Y = \alpha + \sum_j \beta_j x_j + \varepsilon \quad (6)$$

where $\ln Y$ is the logarithm of the income, $x_j s$ are explanatory variables or income components, and $\beta_j s$ are the regression coefficients. The equation can be rewritten as

$$\ln Y = \sum_{j=1}^{J=2} \alpha_j Z_j \quad (7)$$

where $\alpha = [\alpha\ \beta_1\ \beta_2 ... \beta_J\ 1]$, and $Z = [1\ x_1\ x_2 .. x_3\ \varepsilon]$. Then the log-variance of income can be decomposed as

$$s_j(\ln Y) = \mathrm{cov}[\alpha_j Z_j, \ln Y] / \sigma^2(\ln Y) = \alpha_j \mathrm{cov}[Z_j, \ln Y] / \sigma^2(\ln Y) \quad (8)$$

where $s_j(\ln Y)$ is the share of contribution of j factor to the inequality of $\ln Y$ (Qing and Tsui 2005).